

Exercise 6

IS-LM Model

1. The IS-LM Model is a general equilibrium model, which means that there is a common price that clears to two or more markets. There are 2 markets, which are goods market & money market. The price that clears these markets is interest rate. The IS curve represents a negative relationship between interest rate and output. This is because higher interest rate discourages investors from investing and decrease in output ($i \uparrow \rightarrow I \downarrow \rightarrow Y \downarrow$). The LM curve represents a positive relationship between interest rate and output. This is because higher level of income \rightarrow people have more demand for money \rightarrow interest rate increase ($Y \uparrow \rightarrow i \uparrow$). Each point on the IS curve is an equilibrium in the goods market. Therefore, we have the equilibrium condition: $Y = AE$. Each point on the LM curve is an equilibrium in the money market. Therefore, we have the equilibrium condition: $M_s = M_d$.

2. Ceteris Paribus (other things equal), how will each variable affect each curve – shift (to which direction?) or movement?

Variable	IS Curve	LM Curve
$i \uparrow$	movement	movement
$G \downarrow$	shift left	-
$T \downarrow$	shift right	-
$G \& T \uparrow$ equally	shift right	-
$M \downarrow$	-	shift left
$P \downarrow$	-	shift left

3. Explain, together with diagrams, how we can derive the IS curve from Keynesian Cross, and how we can derive the LM curve from the money market.
4. Assume a closed economy with the government. The economy has the following parameters:

$$C = C_0 + C_1(Y - T) \quad I = I_0 - I_1 \cdot i \quad G = G_0 \quad T = T_0$$

$$L(i, Y) = L_Y \cdot Y - L_i \cdot i \quad M = M_0 \quad P = P_0$$

Answer the following questions.

- 4.1 What are I_1 , L_Y , and L_i ?
- 4.2 Why are I_1 and L_i negative?
- 4.3 Derive the IS equation that shows how i and Y are related.

(Hint: Start with the equilibrium condition $Y = AE$. Then, substitute relevant variables into the expression. Lastly, rearrange i to the LHS and everything else on the RHS.)

4.4 Find the slope of the IS curve.

(Hint: The coefficient before Y is the slope of IS.)

4.5 Derive the LM equation that shows how i and Y are related.

(Hint: Start with the equilibrium condition $M_d = M_s$. Then, substitute relevant variables into the expression. Lastly, rearrange i to the LHS and everything else on the RHS.)

4.6 Find the slope of the LM curve.

(Hint: The coefficient before Y is the slope of LM.)

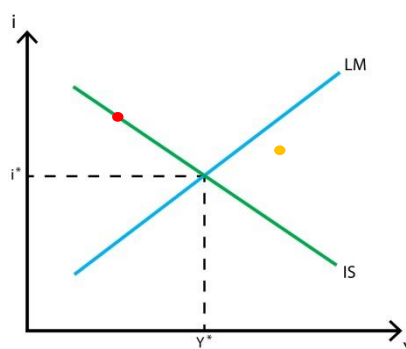
5. From Question 4.4, we can see that the slope of IS curve depends on two factors. Explain how each of these factors affects the slope of the IS curve. We also can see that the slope of LM curve depends on two factors. Explain how each of these factors affects the slope of the LM curve.

6. What is the Crowding-Out Effect?

Suppose that the government increases its spending, i.e. expansionary fiscal policy. Use the IS-LM diagram to explain how the economy moves to the new general equilibrium and the crowding-out effect.

7. Suppose the central bank decreases its money supply, i.e. contractionary monetary policy. Use the IS-LM diagram to explain how the economy moves to the new general equilibrium.

8. Use the graph below to answer the following questions.



8.1 At the **Red** point, which market is in equilibrium, and which is not?

8.2 Explain how the goods and money markets at the **Orange** point will adjust towards the general equilibrium (Y^* , i^*).

9. The government is worried about the effectiveness of its policies. You are to advise which policy – fiscal or monetary – should be used in each of the following cases.

9.1 Consumers have high MPC.

9.2 Investment is NOT sensitive to changes in interest rate.

9.3 Money demand is very sensitive to changes in interest rate.

9.4 Money demand is very sensitive to changes in income (Y).

10. Assume a closed economy with the government. The economy has the following parameters:

$$C = 100 + 0.5(Y_d) \quad I = 80 - 100(i) \quad G = 40 \quad T = 40$$

$$L(i, Y) = 0.5(Y) - 200(i) \quad M = 400 \quad P = 2$$

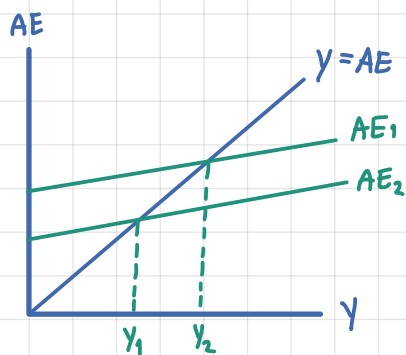
Answer the following questions.

10.1 Derive the IS equation.

10.2 Derive the LM equation.

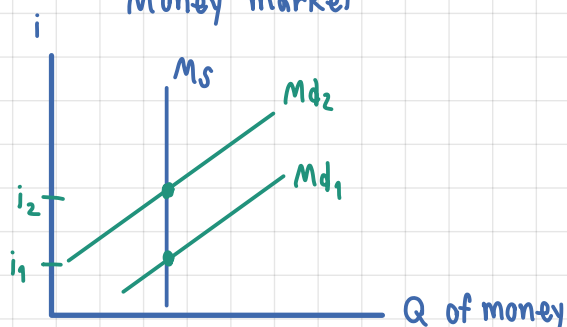
10.3 Find the general equilibrium output and interest rate.

3. Goods market



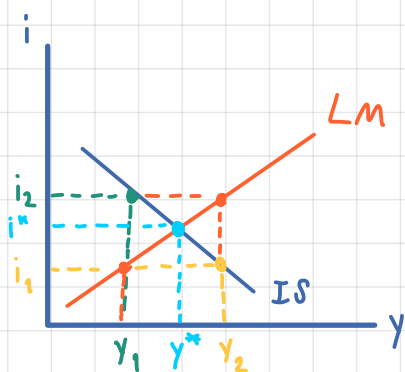
when there is increase in interest rate. the investment will be decrease. It affects to AE decrease, so output also decrease.

Money market



when the interest rate increase, the demand for cash will decrease because people will buy the bond or deposit money at banks.

IS-LM curve



The IS-LM curve shows the interception of money market and goods market at equilibrium of interest rate and output.

- IS shows the relationship in goods market between interest rate and output so when $i \uparrow$ $Y \downarrow$
- LM shows the relationship in money market between interest rate and income when income \uparrow interest rate \uparrow

4.

- 4.1 I_1 is sensitivity of investment to change in interest rate.
 L_y is sensitivity of money demand to change in income.
 L_i is sensitivity of money demand to change in interest rate.

- 4.2 I_1 is negative because when interest rate increase, it will discourage I
 L_1 is negative because when interest rate increase, people will demand less money.

4.3 $Y = AE$
 $Y = C + I + G$
 $Y = C_0 + C_1(Y - T_0) + I_0 - I_1(i) + G_0$
 $I_1 i = C_0 + C_1 Y - C_1 T_0 + I_0 + G_0 - Y$
 $i = \frac{C_0 + C_1 Y - C_1 T_0 + I_0 + G_0 - Y}{I_1} \quad *$

4.4 $\frac{\Delta i}{\Delta Y} = \text{slope of IS}$

$$\frac{\Delta i}{\Delta Y} = \frac{C_1 - Y}{I_1} = \frac{-1}{I_1 M}$$

4.5 $M_d = M_s$

$$L(Y, i) = \frac{M}{P}$$

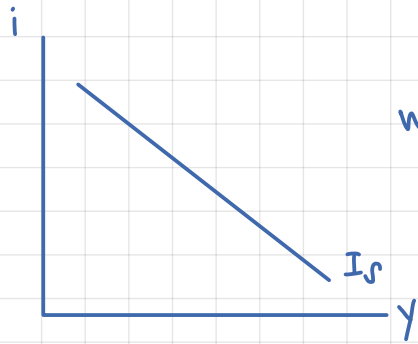
$$L_y Y - L_i i = \frac{M}{P}$$

$$L_i i = L_y Y - \frac{M}{P}$$

$$i = \frac{L_y Y}{L_i} - \frac{M}{P} \left(\frac{1}{L_i} \right)$$

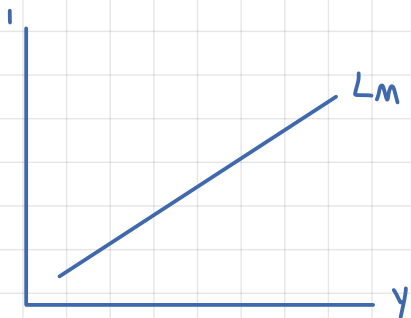
4.6 slope of LM = $\frac{\Delta i}{\Delta Y} = \frac{L_y}{L_i}$

5. slope of IS = $\frac{-1}{I, m}$



when I_1 or m increase for 1 unit
the IS decrease for 1 unit.

slope of LM = $\frac{L_y}{L_i}$



when L_i increase for 1 unit
 L_y will increase for 1 unit.

6. Crowding - Out Effect is public sector spending (G) reduces private sector spending (I)

• Expansionary fiscal policy

→ increase G affect AE to increase, so output (Y) will also increase.

When people have more income, they want to hold more cash

This lead to higher interest rate, but it reduces G & S market since high interest rate. Also, discourage the investor.

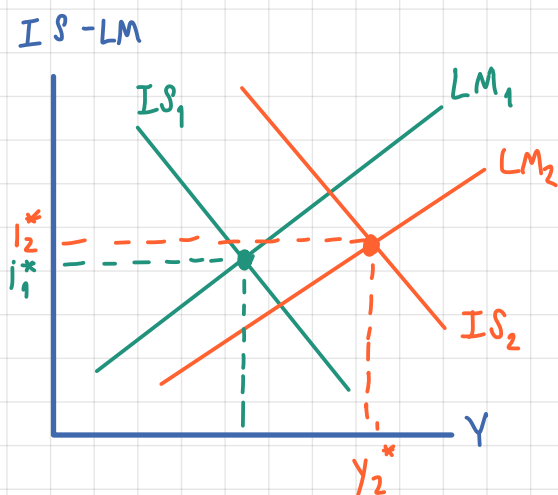
$$I \downarrow \rightarrow AE \downarrow$$

• Expenditure fiscal policy ($G \uparrow$)

$$GM: G \uparrow \rightarrow AE \uparrow \rightarrow Y \uparrow$$

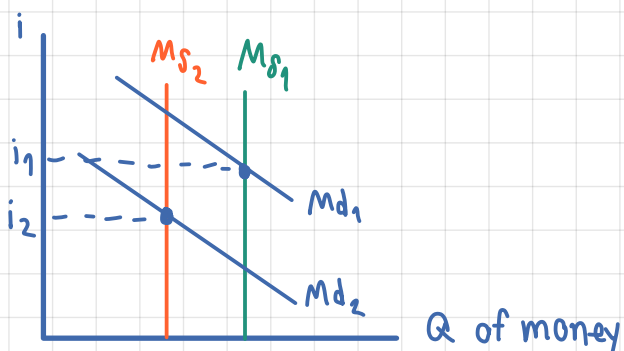
$$MM: Y \uparrow \rightarrow M_d \uparrow \rightarrow i \uparrow$$

$$GM: i \uparrow \rightarrow I \downarrow \rightarrow AE \downarrow \rightarrow Y \downarrow \text{ (crowding out effect)}$$

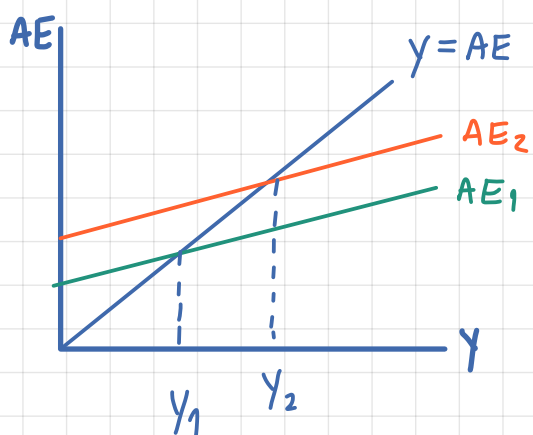


7. central bank decreases money supply.

• money market



• Goods market

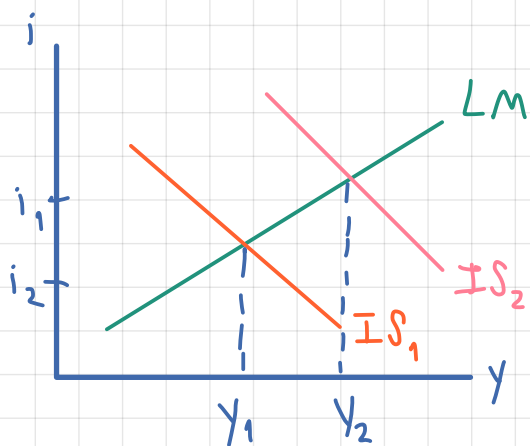


contractionary monetary policy

GM: $i \downarrow \rightarrow I \uparrow \rightarrow AE \uparrow \rightarrow Y \uparrow$

MM: $Y \uparrow \rightarrow Md \uparrow \rightarrow Ms \downarrow$

• IS-LM curve



8.

8.1 At the red point is goods market equilibrium but not money market eqbm.

8.2 At the orange point

(IS) Good market is surplus the output more than the equilibrium.

(LM) Money market is shortage the money demand more than money supply.

9. high MPC \rightarrow high multiplier

Fiscal Policy ($G \uparrow$)

GM: $G \uparrow \rightarrow AE \uparrow \rightarrow Y \uparrow$

MM: $Y \uparrow \rightarrow M_d \uparrow \rightarrow i \uparrow$

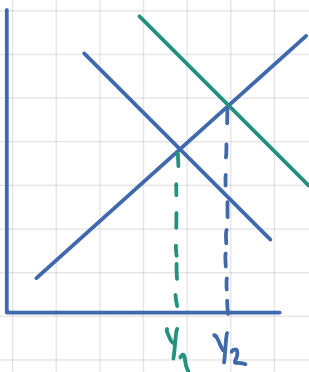
GM: $i \uparrow \rightarrow I \downarrow \rightarrow AE \downarrow \rightarrow Y \downarrow$
(crowding out effect)

Monetary Policy ($M \uparrow$)

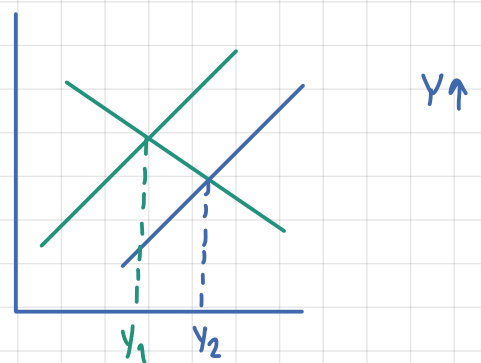
MM: $M \uparrow \rightarrow \frac{M}{P} \uparrow \rightarrow i \downarrow$

GM: $i \downarrow \rightarrow I \uparrow \rightarrow AE \uparrow \rightarrow$

high MPC \rightarrow flat IS



small change in $Y \rightarrow$ not effective
due to large crowding out effect.

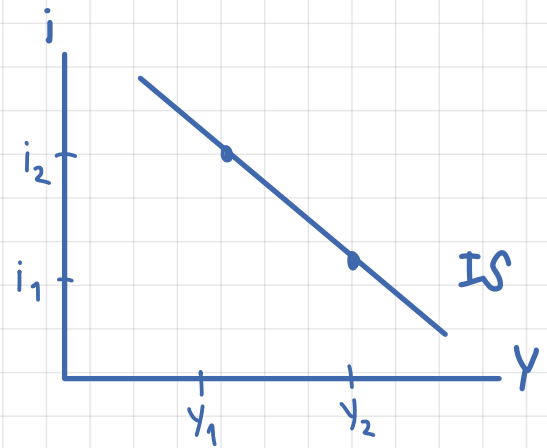


Large Δ in $y \rightarrow$ effective.

10.

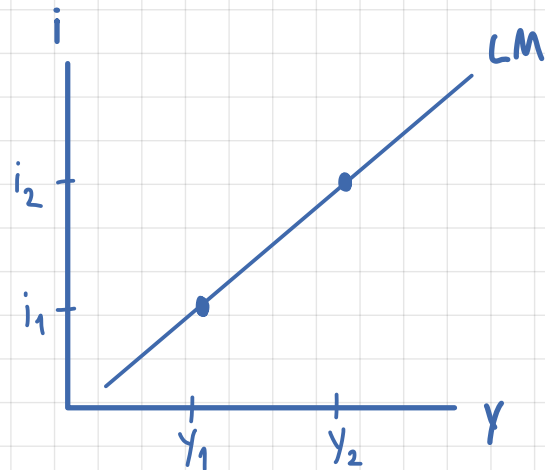
10.1 IS equation

$$\begin{aligned}AE &= Y = C_0 + C_1(Y-T) + I_0 - I(i) + G \\Y &= 100 + 0.5(Y-40) + 80 - 100(i) + 40 \\Y &= 220 + 0.5Y - 20 - 100(i) \\0.5Y &= 200 - 100i \\Y &= 400 - 200i\end{aligned}$$



10.2 LM equation

$$\begin{aligned}M_s &= M_d \\ \frac{M}{P} &= L(Y, i) \\ \frac{M}{P} &= L_y(Y) - L_i(i) \\ \frac{400}{2} &= 0.5(Y) - 200(i) \\ 400 &= Y - 400i \\ Y &= 400 + 400i\end{aligned}$$



10.3 IS = LM

$$\begin{aligned}\cancel{400} - 200i &= \cancel{400} + 400i \\ 0 &= 600i \\ \therefore i &= 0\end{aligned}$$

